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Energy Transitions in Emerging Economies

What Success Looks Like and How to Replicate It

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Introduction

Can emerging economies grow while reducing their greenhouse gas emissions, either on an absolute basis or against some business-as-usual baseline? The Energy Security and Climate Change Program at the Center for Strategic and International Studies engaged in a yearlong project to grapple with “decarbonization” in an emerging economy context. What opportunities exist for policymakers today? How have various places managed to make progress in reducing (or avoiding) emissions while still meeting societal expectations for development? What can we learn from their progress? More broadly: how should we think about the supposed trade-offs between economic development and a cleaner environment and how can we overcome them?

We approached these questions through in-depth case studies. We organized our thinking around three places and four sectors: Vietnam, Ethiopia, and the state of Gujarat in India, the last as a way to look at subnational dynamics in such a vast country. At the sectoral level, we looked at energy access, especially for rural areas, and the power, industrial, and transportation sectors, trying to go beyond a discourse that tends to confuse “electricity” with “energy.”

We wanted to ground discussions in actual experiences and not theoretical constructs. To do so, we examined past success and identified promising opportunities for the future. We did not want to come up with an idealized version of the world—a model-generated pathway from here to “net-zero” that works on paper but not in

practice. We wanted to talk about politics and political economy as much as we wanted to talk about policy tools and metric tons of carbon dioxide (CO₂). We wanted to point to concrete examples of places that had done something right and articulate what others could learn from that experience.

Over the past 12 months, we organized three workshops, one each for Vietnam, Ethiopia, and Gujarat. For each gathering, we invited experts to write papers on the power sector, industry, transportation, and energy access, asking them to document success and see opportunities for the future. Their insights, alongside our research, led to the publication of three reports, as well as the working papers. This report synthesizes the findings from these individual publications and is meant to draw connections among them—we do not repeat everything we wrote, so while this report is a stand-alone product, it draws from the lessons articulated in the earlier reports.

Some of the lessons here will be familiar to academics and practitioners: we found, in various settings, corroboration for long-established ideas and propositions. Others were more surprising. What follows is a blend of the familiar and the surprising, organized around three main sections: what does the energy transition look like in an emerging market; what are the preconditions for success; and how can policymakers and other stakeholders advance the energy transition on the ground?

Why Did We Select These Places?

Vietnam, Ethiopia, and Gujarat had some things in common but also some important differences among them. They are all big, in terms population: over 270 million people live in these three locations, and over 180 million are still classified as rural.¹ Ethiopia's urbanization rate is just 20 percent, Vietnam's is 37 percent, and Gujarat's is just over 40 percent. All three, however, have big urban agglomerations with populations between 4 and 10 million people each. All three places are experiencing rapid economic growth—Ethiopia and Vietnam are among the top performers in per capita income growth between 2000 and 2019, and Gujarat is among the fastest-growing states in India.² Per capita incomes in Vietnam and Gujarat are similar, just short of \$3,000 per capita, but Ethiopia is far poorer, at less than \$1,000 in 2019.³

Their energy systems have similarities and differences, too.⁴ Ethiopia has an energy system dominated by hydropower with limited use of fossil fuels, mostly in transportation and industry. Vietnam and Gujarat rely more on coal, although both have a growing reliance on wind and solar. Gujarat is also a big gas consumer, while Vietnam aspires to use more gas in its energy system. All three locations have made significant progress in providing access to electricity, although Ethiopia's electrification rate was still below 50 percent in 2018.⁵ The relationship between energy and industrial development is also interesting: Gujarat and Vietnam rely on industry for their development, while Ethiopia has articulated an economic development strategy, the Climate-Resilient Green Economy (CRGE), that is explicitly framed as low-carbon, both in the industries it seeks to attract and expand, but also in seeking to offset whatever emissions are produced from economic development.

What Does the Energy Transition Look Like in Emerging Economies?

In many ways, there is no difference between an energy transition in an advanced, developed economy and one in a poorer, developing setting: both will rely on similar technologies, and both are likely going to be enabled by a mix of market forces and government regulation. The wind turbine installed in Texas will be similar, if not identical, to the one installed in Gujarat. Both Florida and Vietnam will need energy efficient air conditioners, even if one might get a more advanced model than the other. A mass transit system in Ethiopia will leverage the same techniques as one in Paris. And so on.

But in other ways, the energy transition looks different away from developed economies. For one, most emerging markets are still building out their infrastructure, and so their challenge is to make sure that infrastructure can be made sustainable, as opposed to replacing whatever earlier generations built. For another, the resources that they can devote to the energy transition are more limited—a generous feed-in tariff in Germany is not the same as a generous feed-in tariff in Vietnam. The institutional and market context is likely to be different as well: transparency, rules, decisionmaking, and dispute resolution are all preconditions for investment, and their presence in emerging economies will vary. Our analysis across these three developing country contexts revealed several common themes.

It is far easier to make progress in the power sector than in transportation, industry, and buildings. This is not surprising, of course, and it confirms the experience of developed countries, where the deployment of solar and wind for power generation has been the main instrument of reducing (or avoiding) CO₂ emissions. In all three cases, there was far more progress in generating low-carbon electricity than in reducing emissions from industry, electrifying passenger transportation or supporting low-carbon transport modes, or avoiding emissions from buildings.

The tool kit to boost power generation from renewables is well understood. Gujarat was an early adopter of wind and solar, and Vietnam was successful recently in incentivizing solar—both largely relied on feed-in tariffs and exploited a worldwide trend in falling costs for solar and wind. Both were open to private and foreign capital. And both faced some problems, too: paying generous feed-in tariffs arguably slowed down the development of additional capacity in Gujarat and it might do the same in Vietnam, where there are also questions about the ability of the grid to handle so much solar energy. These examples are reminders that the tool kit is well known but also still evolving: countries are moving away from feed-in tariffs to auctions, and a modern grid is essential to handle increasing shares of renewable energy.

Energy access is still largely dependent on a centralized approach. There is always a debate in the energy and development circles about the role of decentralized and off-grid solutions in bringing electricity to remote areas. Yet in all three of our cases, the expansion of a central grid, driven by a strong mandate and state

institutions, was instrumental in bringing electricity to people and enabled by market reforms that ensured the financial wherewithal to pursue an ambitious agenda of grid expansion and infrastructure investment. But we also saw that access is not enough—the quality of access varies, and there is still a place for off-grid solutions.

In all three cases [Vietnam, Gujarat, and Ethiopia], there was far more progress in generating low-carbon electricity than in reducing emissions from industry, electrifying passenger transportation or supporting low-carbon transport modes.

There is far more focus on electricity than clean cooking fuels, even though both are important the Sustainable Development Goals agenda. In all three places, electrification is a national goal with political salience, one pursued over time by credible state institutions and sold to the public as an urgent and important undertaking. There is rarely a similar focus on clean cooking. As the number of people worldwide without electricity falls below 1 billion, there are still over 3 billion people without access to clean cooking. Our cases showed a far more laissez-faire approach to clean cooking; in Vietnam, for instance, it is mostly rising incomes that has brought clean cooking fuels.

In the transportation sector, we identified fewer success stories but saw the potential of cities eschewing the path of building systems based on private cars. In Vietnam and Gujarat, two-wheelers are important modes of transportation, and their electrification is simpler and easier than that of vehicles. Gujarat also relies heavily on natural gas vehicles, which may only make modest contributions in terms of decarbonization but make a difference in urban air pollution. In Vietnam, mixed-use

neighborhoods are an important legacy feature that promise to lessen transportation needs. In all three places, we saw mixed experiments with public transport options, which tend to be technologically simple but politically hard, especially in environments with rapid and unmanaged urban growth. Transportation, more than other sectors, underscored the prudence in stopping problems before they emerge rather than trying to solve them after they have appeared: good urban planning and urban infrastructure are hard to come by, but they are far easier than reshaping a city built around private cars.

In the industrial sector, we saw more success in sourcing cleaner energy sources than in implementing energy efficiency programs. The record on efficiency improvements was mostly modest, but our cases underscored the important preparatory work that must be done before efficiency can take hold, which includes: socializing the idea, especially with state-owned enterprises; gathering data; creating monitoring programs; and building financing instruments. By contrast, we saw an easier switch to lower-carbon energy sources. In Vietnam, foreign enterprises are willing to source cleaner electricity, and this is a major demand driver for the country's renewable energy industry. In Gujarat, we saw a successful turn to gas for industry—leading to less reliance on coal and oil. In Ethiopia, the country's low-carbon electricity grid ensures that industry starts from a low-carbon base, but the country is also trying to avoid a reliance on heavy, energy-intensive industry and to encourage investment in its eco-friendly industrial parks, although such aspirations are always clashing with the hard reality of needing investment and jobs. The successes here were less clear-

cut, but they existed, and with the frameworks established at a much earlier phase of development, it is likely they will bear fruit as implementation capacity improves.

In buildings, we saw few clear success stories but enormous opportunity for smart design and policy to avoid emissions. So much of the building stock in the developing world has yet to be built. The urbanization wave is, in some ways, a welcome development for energy use—people are far more efficient energy users in big cities. But the growing demand for cooling was a recurrent challenge. Efficiency standards have a major role to play, but these need to be aligned across geographies, and crucially, they need to enable local industries to survive and thrive. We also saw a lot of evidence of tighter standards merely pushing less efficient appliances into the second-hand market, a reminder of the pent-up demand and the need to not merely sell new efficient appliances but also take out of circulation older, less efficient ones.

What Are the Ingredients of Success?

The choices available to a country are, in part, globally determined: a big reason that Vietnam and Gujarat are able to install wind and solar is because other countries have invested in these technologies before them, helping to bring down the cost of these technologies and establishing a tool kit for deployment.

Our first observation about how to bring about an energy transition is that **it is hard for an emerging economy to lead—but there is a difference between being an early or a late adopter.** When one thinks about the technologies of the future—such as batteries, fuel cells, hydrogen, carbon capture and storage, heat pumps, or direct air capture—few countries are likely to take the lead in developing these technologies, although this does not preclude participation in the complex international supply chains that such technologies will rely on. What matters for an emerging economy is not necessarily leadership in research and development but the ability to adopt a technology quickly once it has matured. Keeping up with technological innovations and best practices for adoption is arguably more important than research and development, and early adoption seems to have been a wise strategy for our case studies.

But countries can anticipate changes in technology and position themselves as suppliers or manufacturers. Ethiopia, Gujarat, and Vietnam are pursuing forms of “green industrial policy,” although it is too early to tell how successful such policies will be. Gujarat is investing in manufacturing capacity along the electric vehicle (EV) supply chain, Ethiopia is encouraging industries to use the cleanest manufacturing processes possible, and multinationals in Vietnam are looking to source their electricity from renewable energy, positioning themselves for a world where carbon intensity might be a differentiator. None of these strategies are necessarily destined for success, but they reflect genuine political incentives and economic opportunities that seem only likely to grow as the energy transition progresses.

Every year, it is becoming easier to adopt low-carbon solutions. Installing solar today is cheaper than last year, which was cheaper than two years ago. Next year, it will likely be cheaper still. The opportunity set for countries to implement low-carbon

solutions keeps growing, and that awareness is an essential element of strategic planning. It is easy to get caught up with assumptions and mental models that are outdated; instead, we see an ever-expanding space for being able to supply sufficient energy and facilitate development without compromising on reducing CO2 emissions.

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Competitive prices, however, are not enough by themselves. **Energy systems do not necessarily follow the path of least cost—politics, political economy, and institutions matter.** Time and again, our case studies underscored the importance of political leadership—leaders making something a priority and pushing for bureaucracies to do something. We also saw the importance of political economy and ensuring alignment of political and business interests, in particular, in driving outcomes. The ability to align private capital behind a low-carbon goal was probably the easiest way to supercharge those goals. And finally, there

is just no substitute for high-quality institutions that can plan, lay out targets, make decisions, and adjudicate competing interests. For example, all three places have laid out high-level “green growth” frameworks and policy platforms that set a tone in terms of direction, even if they may not yet filter down to every decision.

Our cases also showed how success begets success. Electrifying the villages in Gujarat allowed power companies some fiscal health and that, in turn, enabled them to afford feed-in tariffs for renewable energy sooner than other places in India. In Gujarat, we also observed the network effects in building a gas market: the ability to share infrastructure means the next customer is often easier to serve than the previous one. And the demonstration effect is powerful, too: attracting foreign investment makes it easier to attract more investment. Successes also generate vital political support and legitimacy, providing leadership more leeway to experiment and take risks on low-carbon policy options.

Finally, there is a complicated relationship between higher incomes and energy outcomes. In some cases, higher incomes made it much simpler to achieve energy outcomes: the ability to pay for electricity or clean cooking fuels, for example. But in others, the aspirations that come with higher incomes underscored the necessity of early policy interventions: to prevent an excessive reliance on privatized motorization, for instance, or on energy inefficient appliances. These cases are also demonstrating how it is easier to avoid carbon emissions by investing in sustainable industries that generate future growth opportunities than to try and reform existing industries built on a more carbon-intensive model.

Recommendations for Policymakers and Stakeholders

What do all these insights mean for policymakers? We have identified six major takeaways:

- 1. “Clean up later” can be costly—it is best to intervene early and mitigate against path dependence.** It is very tempting to focus on economic development without regard to the environment and then come back to solve environmental problems later. The drawbacks of this approach are well known, of course, chiefly in terms of public health (even ignoring climate change). But this is also a false choice many times. We saw several instances where an early intervention could make a big difference that simplified or solved the trade-off between growth and pollution: in encouraging two-wheelers or mass transit, for example. And we saw repeatedly that choices create path dependence: Vietnam is building coal plants in part because it built coal plants in the past. There is a high risk that the “later” in “clean up later” keeps getting postponed due to institutional inertia—it is thus an idea best avoided.
- 2. There is no substitute for getting institutions and markets right.** This includes creating proper and transparent structures, ensuring prices that clear supply and demand, enabling private capital to be deployed, and allaying the concerns of financial institutions. Even in instances where the state had a heavy hand—say in providing electricity—the right structures were essential in maintaining the health of the companies meant to keep the lights on. This work is fundamental even if politically hard: ensuring cost recovery for investment, allowing prices to fluctuate, capturing externalities, forcing hard budget constraints on state-owned enterprises, and so on. It is very hard to make progress in decarbonization if market forces are moving against you.
- 3. Standardization is an essential precondition for scale.** In several instances, we saw that the uptake of innovations were dependent on new institutions or processes, such as for a new energy efficiency program, a power purchase agreement to buy clean electricity, or a new mode of transportation. In all of these instances, financing and customer adoption depend on trust and the ability to verify what someone is trying to sell. In these instances, networks of public institutions, companies, non-profits, and financiers create an ecosystem that is critical for success.
- 4. Engagement is essential—with industry, state-owned enterprises, associations, non-profits, and multilateral organizations.** Because energy systems do not always follow the path of least cost, showing up matters. Speaking to public institutions and companies matters. Lobbying for policies matters. Helping people see their options matters. In one of our cases, looking at the procurement of clean electricity in Vietnam, success was largely due to a group of people who kept showing up and pushing for it. Engagement matters.

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5. Let first movers move. The changes in technology alone are hard for any government to keep up with. Add in changes in fuels, business models, and financing mechanisms and it becomes very hard to plan ahead for all the possibilities that might be open to a country. One key theme that kept emerging in our cases was experimentation and allowing small groups, often partnerships between public and private institutions, to try out something new. In some cases, experimentation only needs a modest permission; but in other cases, experimentation depends on strong structures that favor new news. Asking “how easily can someone try something new” is a good lens for policymakers to assess their deployment environment.

6. It is very hard to declare ultimate victory; it is important for stakeholders to celebrate wins and keep moving. Even the most successful cases we identified are far short of what total success looks like. It is easy to look at the big challenge and get daunted—when penetration reaches 10 percent, for instance, one can look at the 10 percent that happened or the 90 percent that remains. In our cases, we saw policymakers that were able to cheer success and keep tweaking the model to unlock the next tranche of success. We also saw instances—in Gujarat, for example—where a former leader lost ground to other states, a reminder that this is a marathon, not a sprint, even if, in terms of speed, the change needed is more sprint-like.

Conclusion

The lessons across these three places—Vietnam, Gujarat, and Ethiopia—are encouraging. We observed places able to deploy cutting-edge technology and solve problems. We saw public institutions leading and coalitions between state-owned companies, private industry, and non-profits coming together to create networks that lobbied for change or pushed the boundaries to try something new. Equally important is what we did not see: we did not see a place hampered by the effort to decarbonize—a country whose economic growth or overall prosperity was somehow hit when it tried to implement a solution that was less carbon intensive. Instead, these success stories came alongside, and were often enabled by, rapid economic growth, rapid urbanization, and impressive declines in poverty. If there is a balancing act between economic growth and decarbonization, it is far more evident in the minds of policymakers and thinkers than it is in the specific places and sectors that we analyzed—even though deeper gains in decarbonization will be harder to achieve, a fact that applies to both mature and emerging economies. We saw plenty of examples of real success and plenty of opportunities to tackle problems using simpler interventions today. And that, in the end, is the most heartening lesson of all.

Endnotes

- 1 Data for population and urbanization for Vietnam and Ethiopia are for 2020 and come from “Data Query,” United Nations, World Urbanization Prospects: The 2018 Revision, <https://population.un.org/wup/DataQuery/>. Data for Gujarat refer to the 2011 Census from “Gujarat Population 2011,” Census2011.co.in, <http://www.census2011.co.in/census/state/gujarat.html>.
- 2 In constant dollars per capita from 2000 to 2019; “GDP per capita (constant 2010 US\$),” World Development Indicators, World Bank, accessed August 10, 2020, <https://data.worldbank.org/indicator/NY.GDP.PCAP.KD>. For Gujarat, data from Reserve Bank of India, *Handbook of Statistics on Indian States 2018-19* (New Delhi: 2019), <https://m.rbi.org.in/Scripts/publications.aspx>.
- 3 “GDP (current US\$),” World Development Indicators, World Bank, accessed August 10, 2020, <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD>.
- 4 Data for Vietnam and Ethiopia from “Data and Statistics,” International Energy Agency, accessed August 10, 2020, <https://www.iea.org/data-and-statistics>.
- 5 “Tracking SDG 7,” Energy Sector Management Assistance Program, Accessed August 10, 2020, <https://trackingsdg7.esmap.org/country/ethiopia>.

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